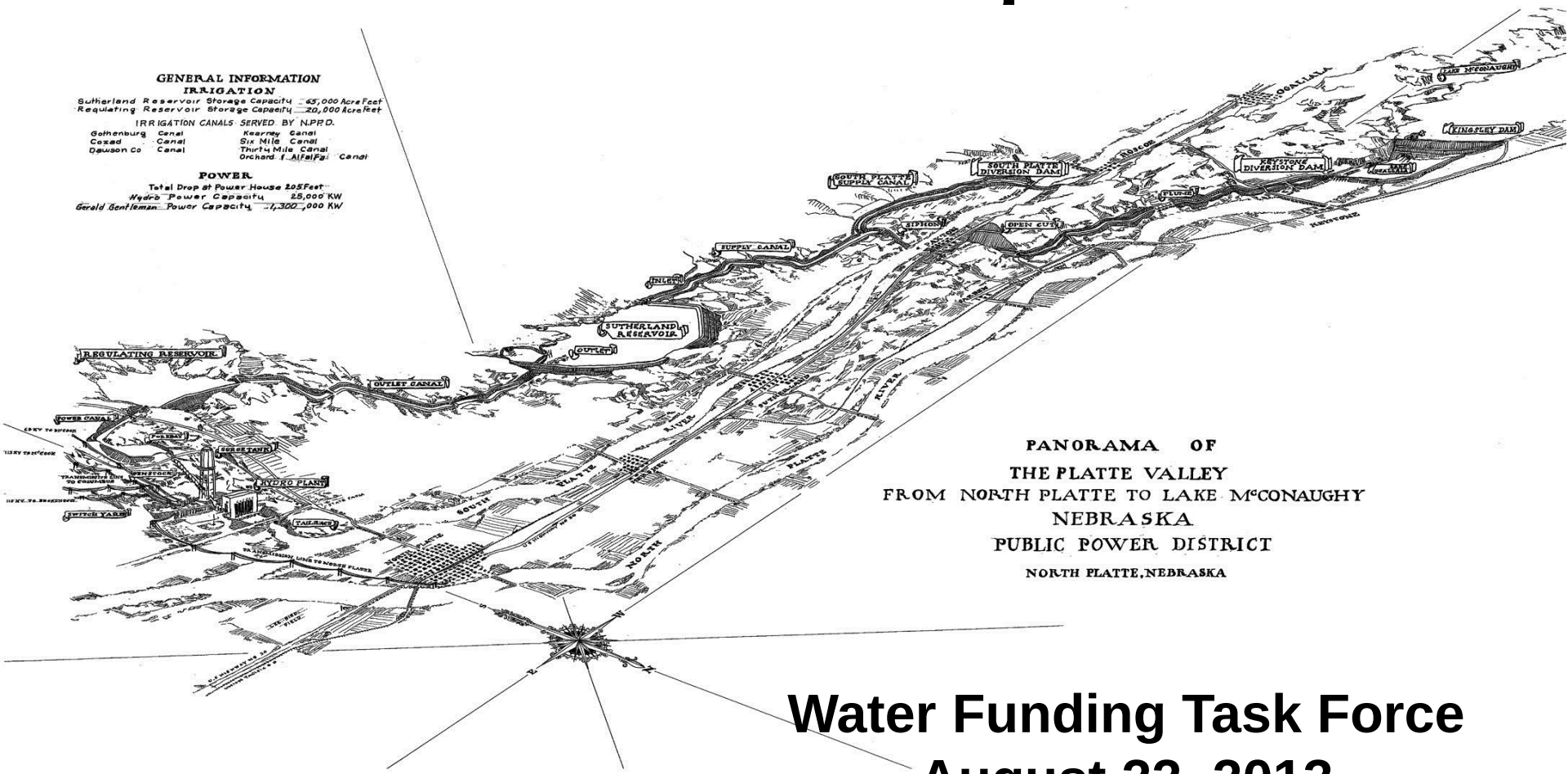
Surface Water Projects and Irrigation
Sutherland Project



Water Funding Task Force
August 22, 2013
Brian Barels
Nebraska Public Power District

Topics

- Sutherland Project Description
  - Surface water irrigation
  - Storage for supplemental water supplies
  - Power generation
  - Additional benefits
- Sutherland Reservoir Conjunctive Management Project
- Issues – Sustainability of Natural Flow Water Supply
- Projects – Opportunities for funding

Sutherland Project History

- Constructed by Platte Valley Public Power District between 1934 – 1939
- The project was built to provide supplemental storage water to eight canals from Lexington to Kearney
- Hydropower was added to the project at the request of the Federal Government to ensure repayment of construction bonds.
- Sutherland Reservoir designed to store water for irrigation and hydro generation at the North Platte Hydro
  - Original design capacity – 164,000 AF
  - Capacity not achieved due to the amount of seepage
  - Present maximum capacity – 65,000 AF

  NPPD stores 125,000 AF in Lake McConaughy to provide irrigation water supply
- NPPD and Central, by agreement, operate projects to optimize the beneficial uses of each district's water supply

Sutherland Project

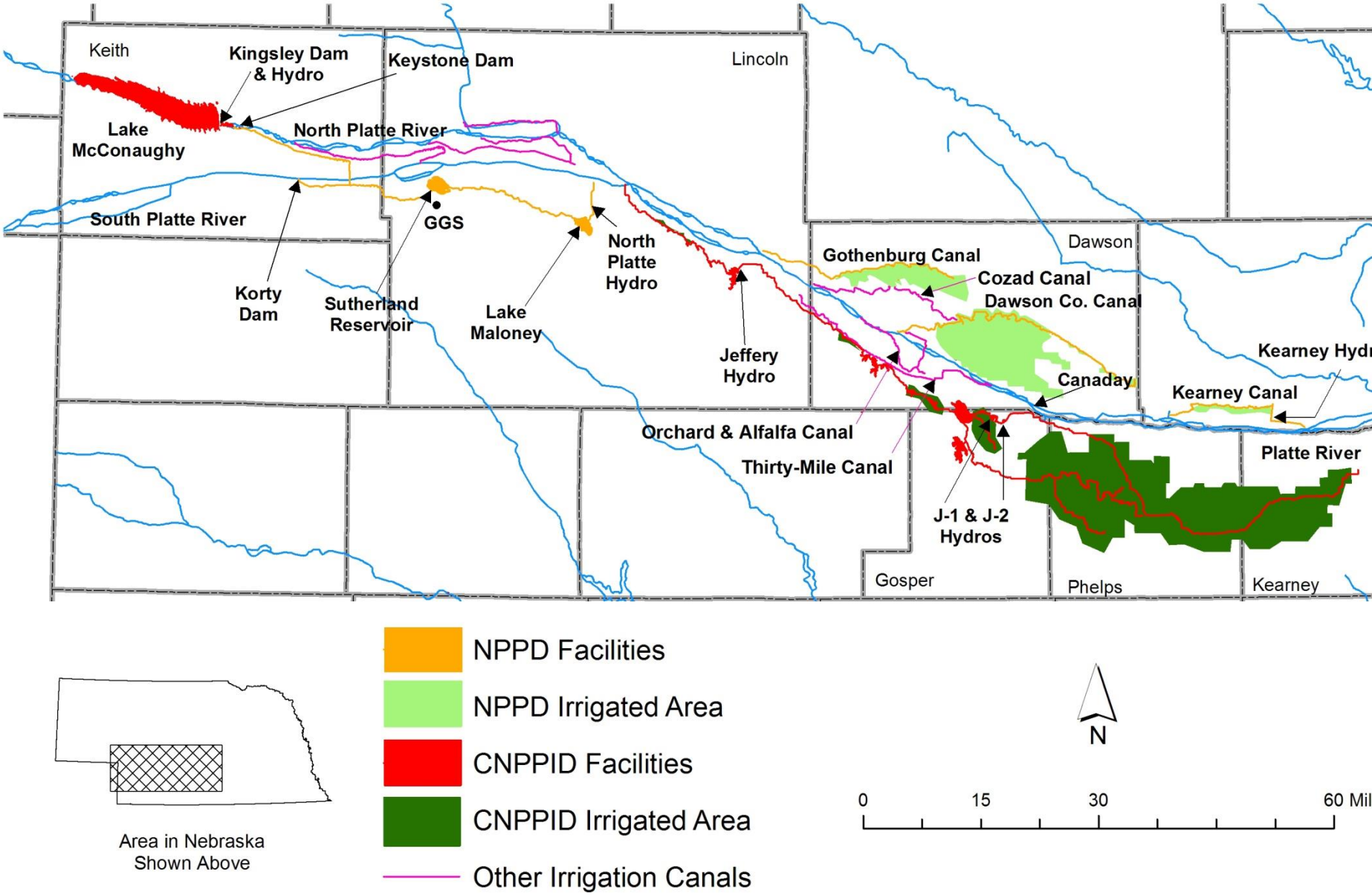
Facilities

- Lake Ogallala, Keystone Diversion Dam, Supply Canal, Korty Diversion Sutherland Reservoir, Outlet Canal, Lake Maloney, North Platte Hydro, Tailrace Return to South Platte River

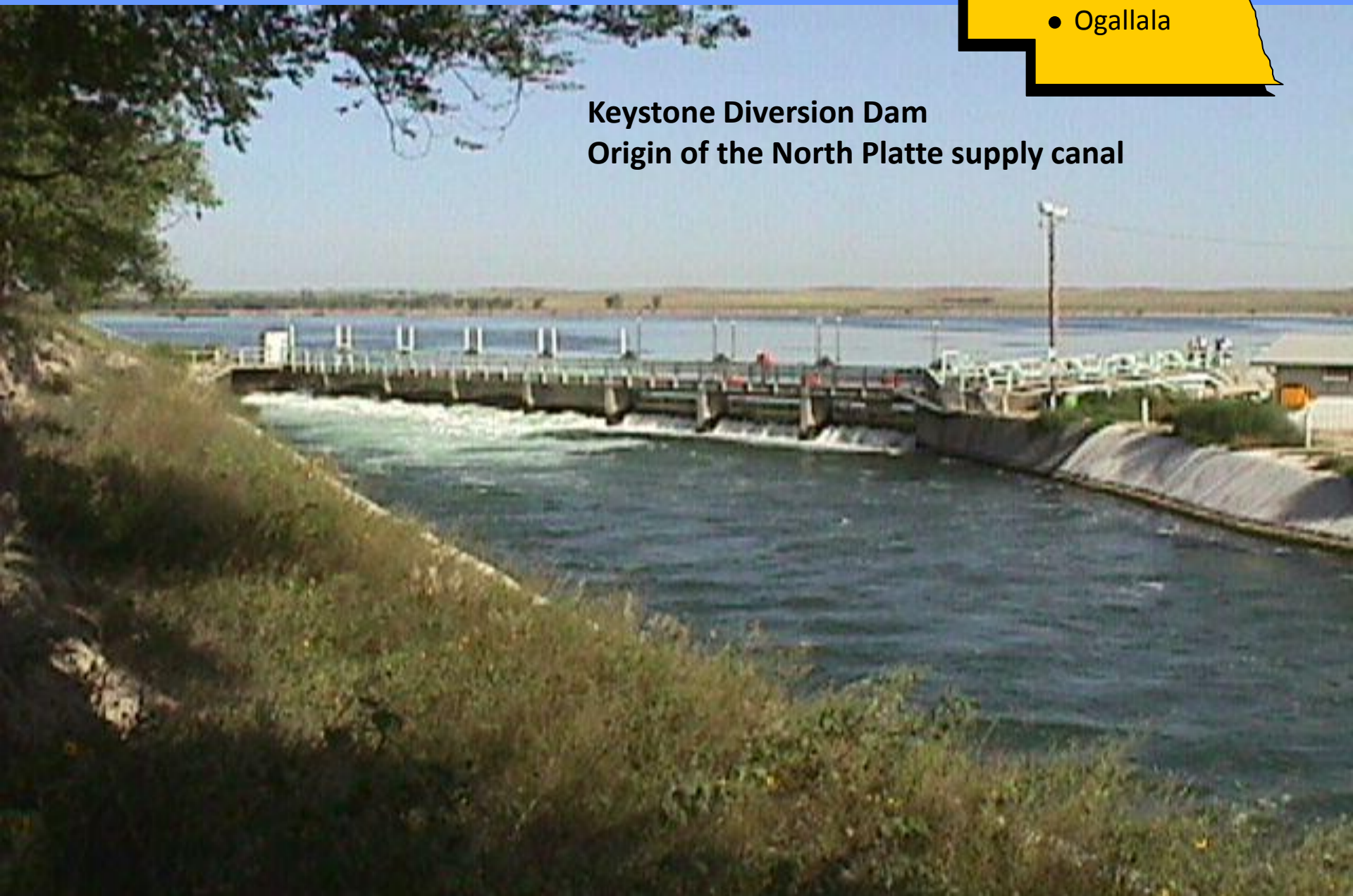
Benefits

- Supplemental storage water for increased agricultural production
- Electric power – Hydropower
- Habitat for fish and wildlife
- Recreation
- Flood control
- Cooling water for GGS
- Groundwater recharge quantity and quality
- ESA compliance

NPPD's Water Supply System



Keystone Diversion



Sutherland Supply Canal

Open Cut
Brings water from the North Platte river valley to the South Platte river valley

Sutherland Supply Canal – Paxton Siphon

Siphon
Runs under the city of Paxton, UP's main line tracks, the South Platte river, & I-80

Inlet to Sutherland Reservoir

NPPD Generation - Platte River Basin

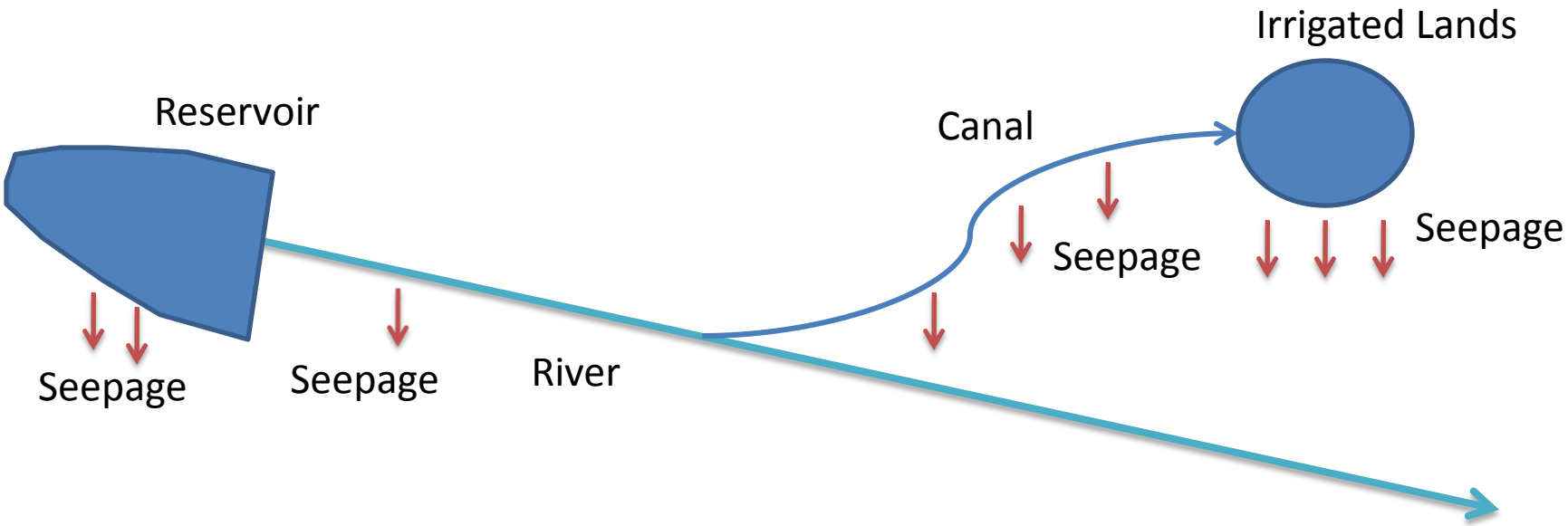
- Generators rely on both the North and South Platte Rivers, Lake McConaughy, Sutherland Reservoir as well as groundwater for cooling water needs
- Natural flow provides water for:
  - Storage in reservoirs
  - Hydroelectric power production – 140 MW (NPPD & Central)
  - Condenser cooling – 1365 MW and 120MW
- Platte River system provides 1625 MW's of generation, 50% of NPPD's capacity
- Surface water is used and reused for multiple beneficial uses as water travels downstream including recreation, hydropower, recreation, recreation, cooling water, recreation, hydropower, recreation, hydropower and irrigation, as well as recharge of groundwater supplies (quality and quantity), water supplies for municipalities, river flows for recreation and habitat

Irrigation Benefits

- NPPD water storage
  - 125,000 AF in Lake McConaughy
  - Sutherland Reservoir
  - Lake Maloney
- NPPD delivers up to 102,000 AF of supplemental storage water to 6 canals and 80,000 surface water irrigated acres
  - 3 canals owned by NPPD, 3 canals through contract
    - Delivery provides water for hydropower, cooling and recreation
    - Surface water recharges groundwater (quality and quantity) and Platte River
  - Conjunctive management study underway with CPNRD and NDNR

Surface Water Project Benefits

- Reservoir, canal, and irrigation seepage and recharge benefits the local aquifer. This effectively imports water to the aquifer which increase groundwater storage and/or offsets groundwater pumping



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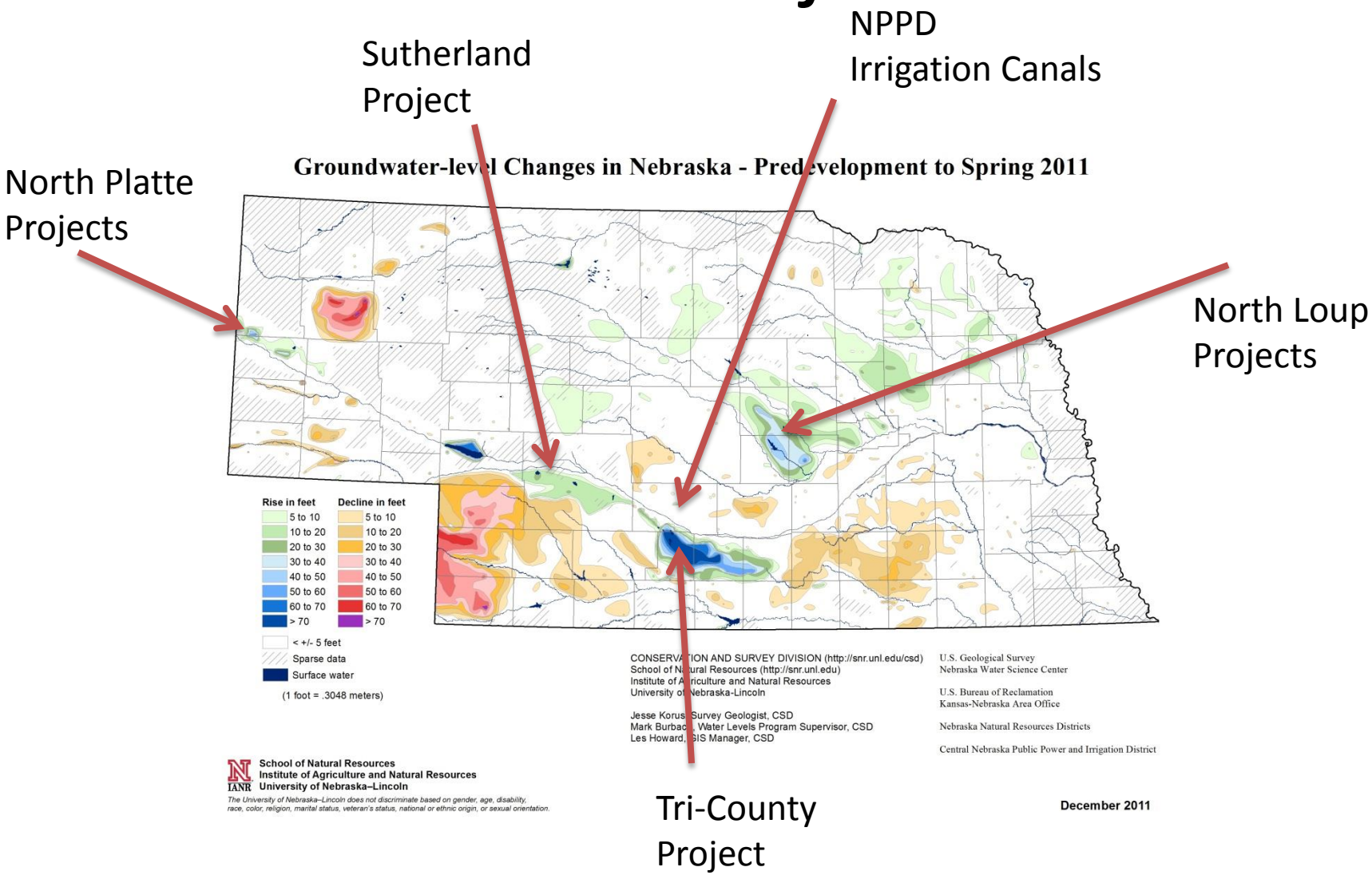
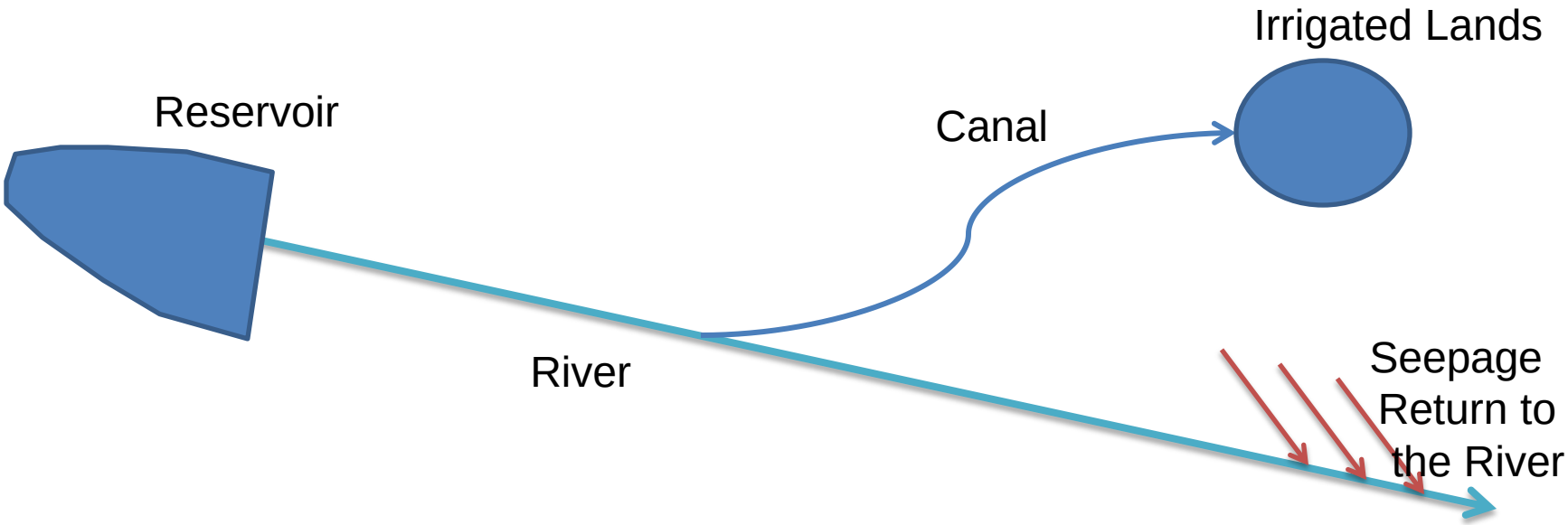
Surface Water Project Benefits



Surface Water Project Benefits

- Seepage and recharge water return to the river downstream, if not consumed locally. This water often provides a portion of the water supply for the next downstream use or recharge of the aquifer



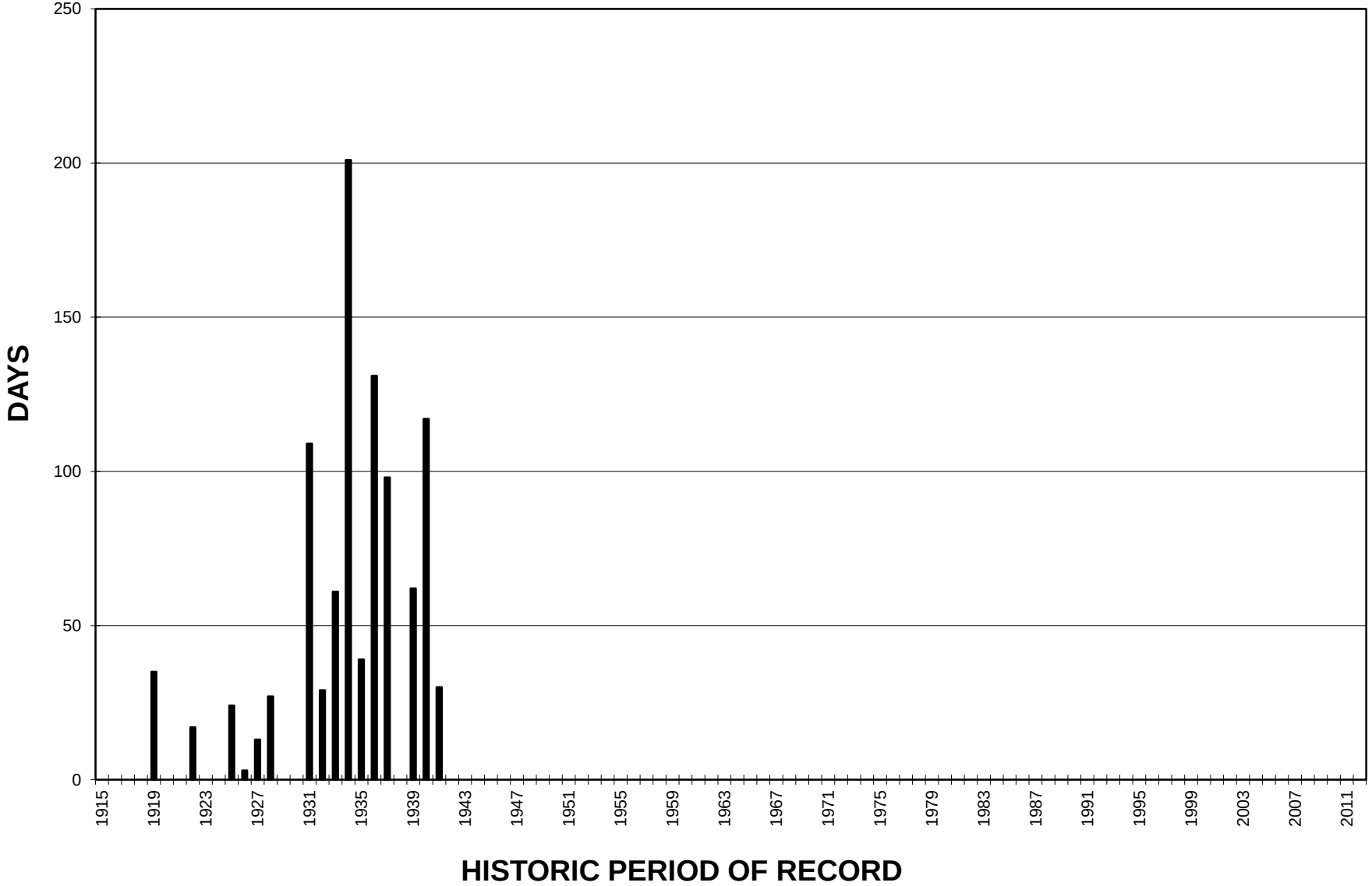
About Nebraska's Platte River – Stateline to Lake McConaughy

- Groundwater and surface water are connected due to geology and the many surface water canals
  - Surface water seepage from the canals is a major source of groundwater recharge and return flows to the Platte River
  - Groundwater return flows from irrigation canals have turned streams that flowed part of year into streams that flow year around
  - Without this recharge, most of the now perennial tributaries would return to the predevelopment state and be dry most of the year
  - Without the canal seepage, the large supply of groundwater would not be available to the wells in the area.
  - Return flows, on which downstream surface water appropriators depend, would also disappear

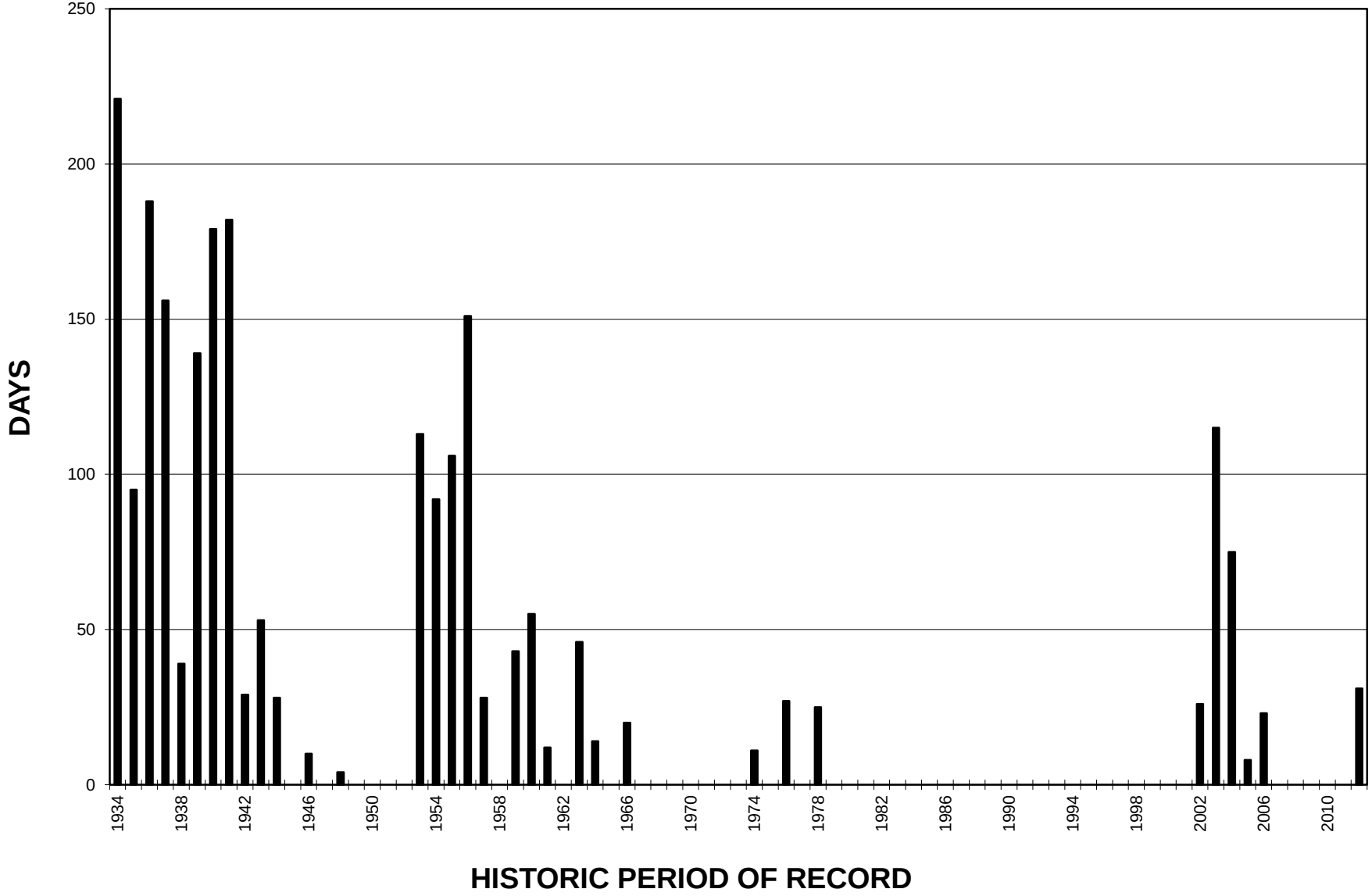
About Nebraska's Platte River
North Platte to Grand Island

- 1940 – The Nebraska Supreme Court noted:
  - experts with experience on the river estimate that the loss in delivering water from North Platte to Kearney Canal with a wet river bed amounts to three times the delivery and with a dry riverbed it is almost impossible to get water though
  - “It is also shown that the water table has been affected materially by pump irrigation”
- Flood flows in one reach may be lost to seepage in a downstream reach
  - The largest recorded flood flow on the South Platte River could not be detected as an increase on the Platte’s flow at Grand Island
- Over time, the Platte became a gaining stream due to Central’s canals, on the south side of the river and NPPD’s delivery of storage water to canals on the north
- Seepage to the river from the large groundwater mound created from Sutherland east to Minden by canal losses and irrigation seepage has increased flow in the big bend reach of the river
- Wells pumping groundwater for irrigation took hold in the 1950’s and continued through 2004 above Columbus affecting directly and over the long-term on the amount of water flowing in the river

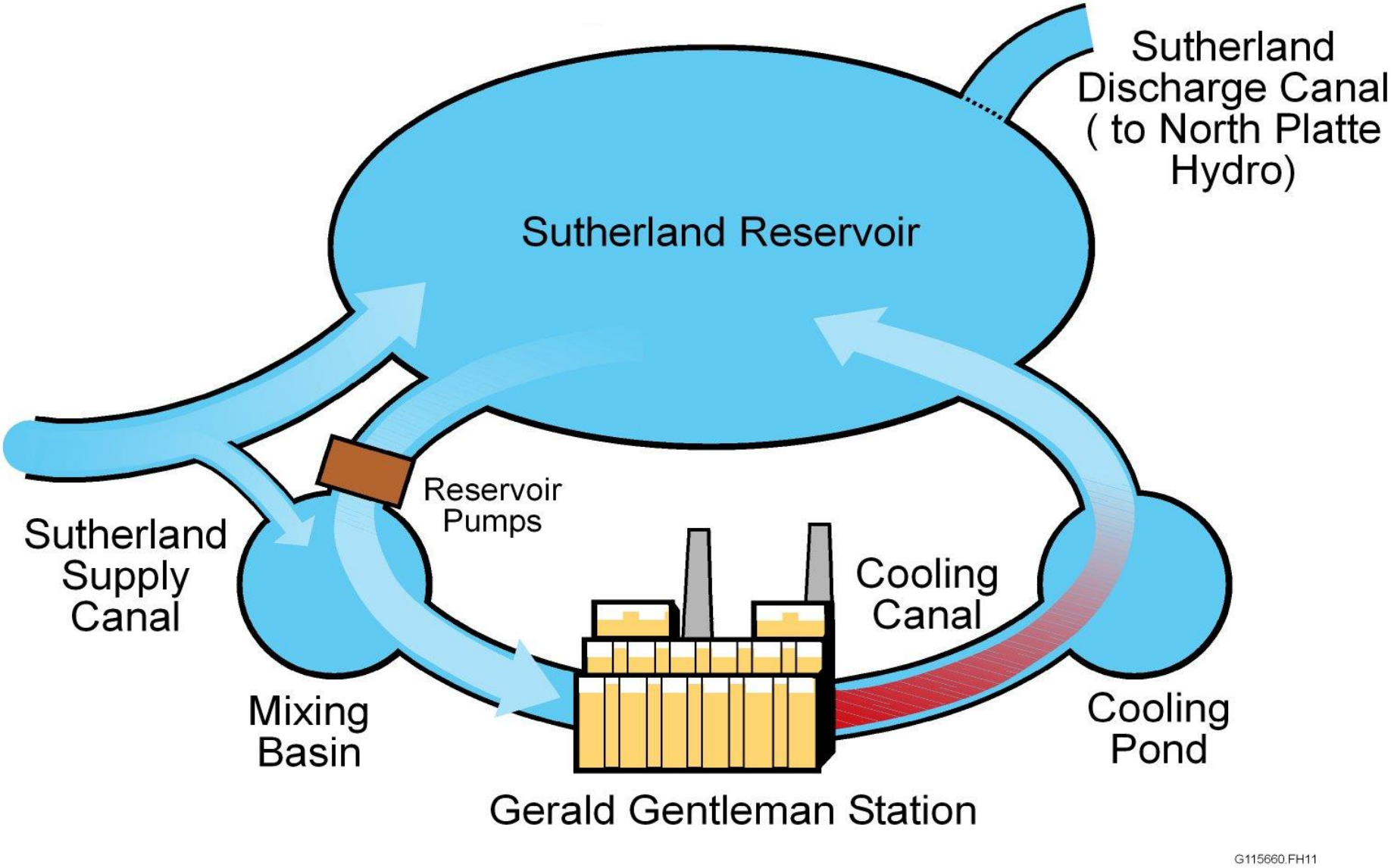
PLATTE RIVER ANNUAL OCCURRENCE OF NO FLOW DAYS AT OVERTON



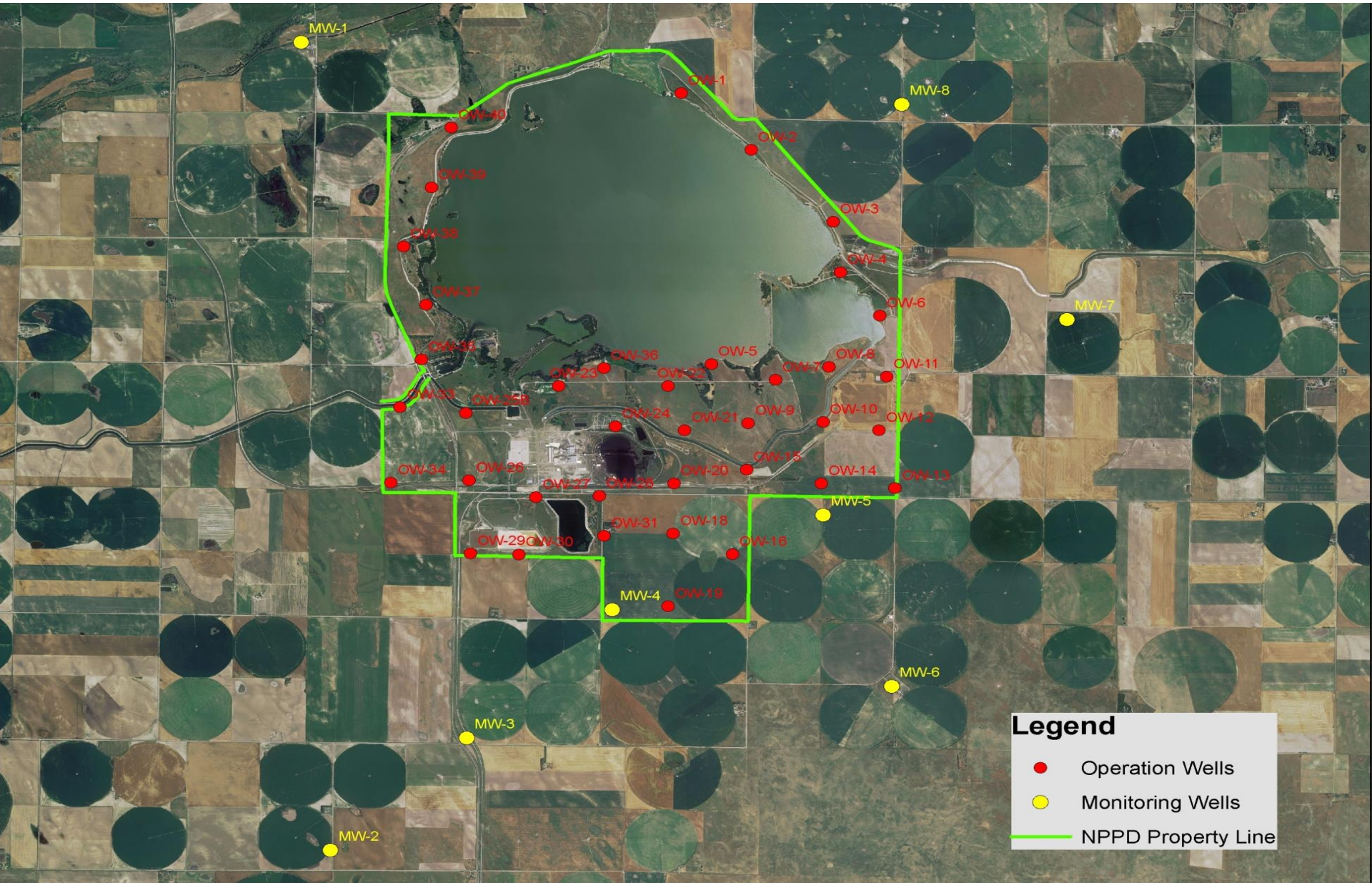
PLATTE RIVER ANNUAL OCCURRENCE OF NO FLOW DAYS AT GRAND ISLAND



Drought Preparation and Conjunctive Management



NPPD Wells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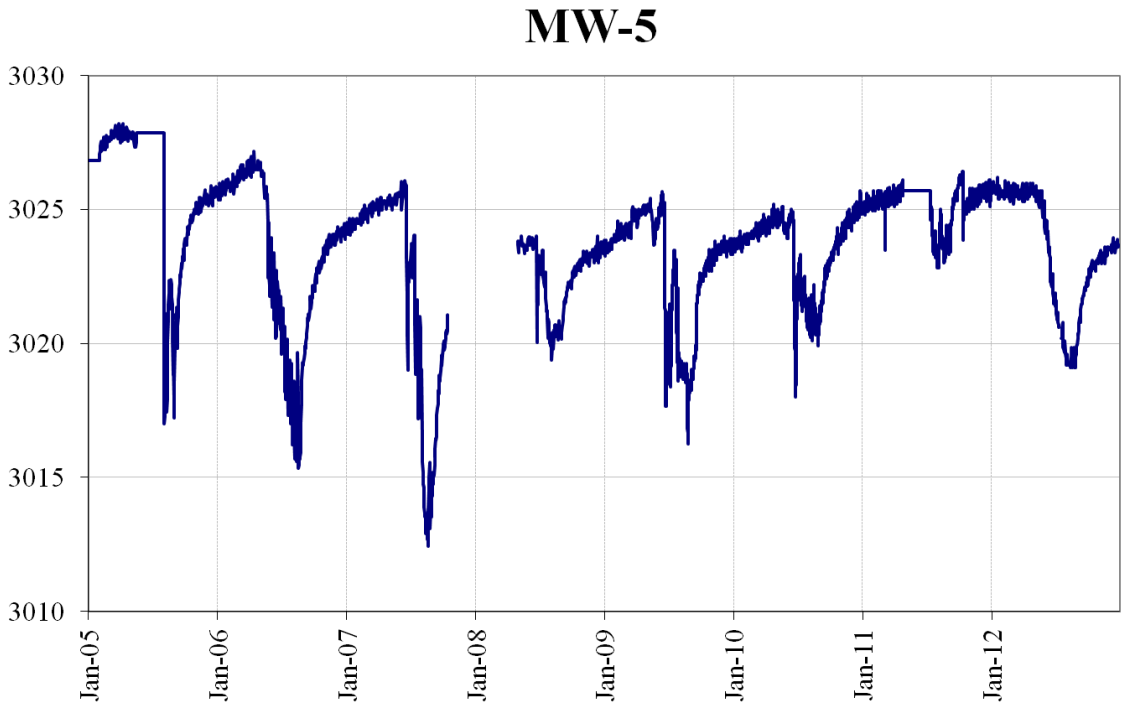
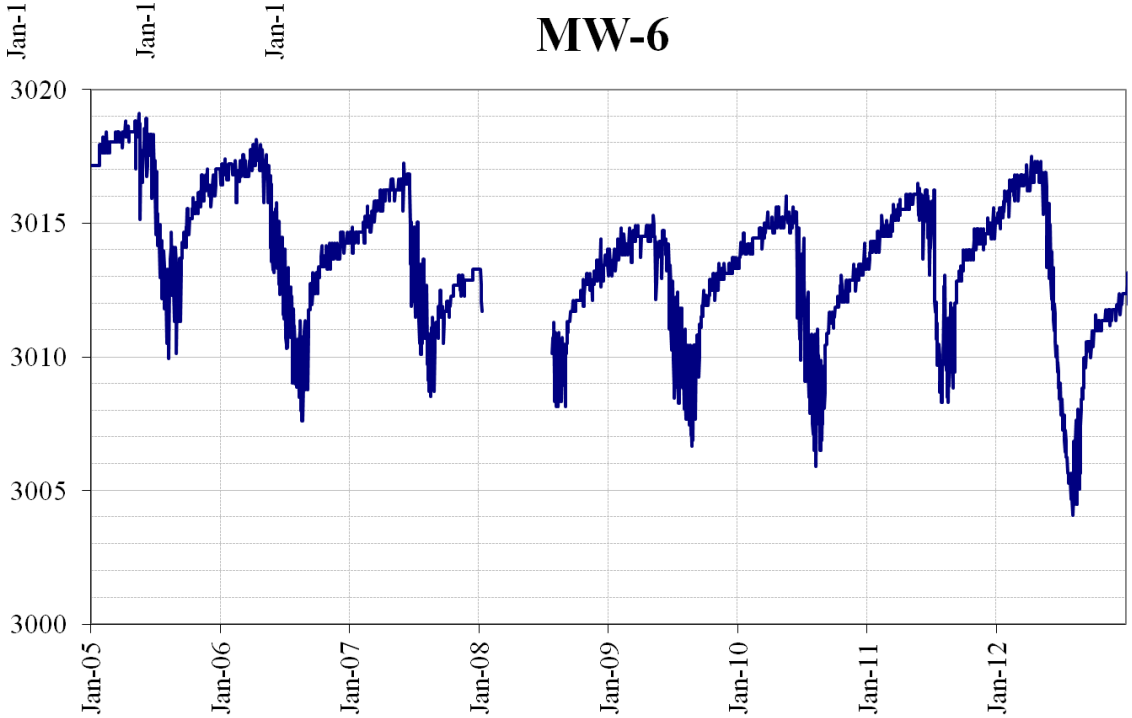
Legend
Operation Wells
Monitoring Wells
NPPD Property Line

SE of Reservoir





Issues – Natural Flow Water Supply

- 80% of North Platte River winter flows at Lewellen historically originated from return flows from upstream surface water irrigation
- Impacts to lower Platte River water supplies
  - Drought and reduced precipitation
  - Increase in groundwater irrigation
  - Changes to upstream surface water irrigation
    - Conservation
    - Increase efficiencies – increased consumption and reduced recharge
    - Reduced deliveries
    - Land use changes
    - Cropping changes
    - Consumptive changes
  - Others?

Projects – Opportunities for Funding

- Increased reservoir storage
  - Sutherland Reservoir or new reservoirs
- Winter operations of irrigation canals
  - Conjunctive Management deliveries
  - Delivery to reservoir sites
- Irrigation diversion structure modifications
  - By-pass flows for instream uses
  - Structure modifications for automation and measurements
- Lining of canals for conservation
  - Based on no negative impacts to downstream and groundwater supplies
- LB 962 funding to return supplies to 1997 and fully appropriated flow levels
- Studies of Platte River water supplies, uses, consumption and integrated surface and groundwater resources
  - River gains and losses
  - Effects of groundwater pumping on baseflow and losses
  - Effects of changed irrigation practices
  - Effects of irrigation efficiencies
- Funding sources – Limited
  - USBR – Water Smart
  - NRD's – conjunctive management

Project – Opportunities for Funding

Continued

Overshot river gate for winter operations along with other in-canal modifications $4.5 – 7M

Questions?